

## **CLAIMS**

1) A piezoelectric transducer comprising:

a) a chamber diaphragm having first and second opposing surfaces, a given chamber diaphragm thickness, and a given chamber diaphragm width,

b) a mesa having first and second opposing surfaces, a given mesa thickness, and a given mesa width wherein the first surface of the mesa is adjacent to the first surface of the chamber diaphragm and the mesa further comprises at least one mesa opening, and

c) a piezoelectric material element having a given piezoelectric material element width adjacent to the second surface of the mesa.

2) The piezoelectric transducer of claim 1 wherein the mesa further comprises an insulative layer at least partially on the second surface of the mesa.

3) The piezoelectric transducer of claim 1 further comprising an electrical contact layer at least partially interposed between the piezoelectric material element and the second surface of the mesa.

4) The piezoelectric transducer of claim 1 wherein the mesa comprises a substantially insulative material.

5) The piezoelectric transducer of claim 1 wherein the mesa comprises a substantially conductive material.

6) The piezoelectric transducer of claim 1 wherein the chamber diaphragm comprises a substantially conductive material.

7) The piezoelectric transducer of claim 1 wherein the chamber diaphragm comprises a substantially non-conductive material.

- 8) The piezoelectric transducer of claim 1 wherein at least a portion of the at least one mesa openings is at least partially filled with adhesive.
- 9) The piezoelectric transducer of claim 1 wherein the mesa further comprises at least one mesa groove.
- 10) The piezoelectric transducer of claim 9 wherein the mesa groove extends between at least two mesa openings.
- 11) The piezoelectric transducer of claim 1 wherein the mesa thickness is at least approximately 10% of the chamber diaphragm thickness.
- 12) The piezoelectric transducer of claim 1 wherein the mesa width is less than the chamber diaphragm width.
- 13) The piezoelectric transducer of claim 1 wherein the piezoelectric material element width is greater than the mesa width.
- 14) The piezoelectric transducer of claim 13 wherein the piezoelectric material element width is greater than the chamber diaphragm width.
- 15) The piezoelectric transducer of claim 1 wherein the mesa further comprises a mesa edge support and a mesa interior.
- 16) The piezoelectric transducer of claim 15 wherein the mesa edge support further comprises at least one mesa opening.
- 17) The piezoelectric transducer of claim 16 wherein at least a portion of the at least one mesa opening is at least partially filled with adhesive.
- 18) The piezoelectric transducer of claim 15 wherein the mesa edge support further comprises at least one mesa groove.
- 19) The piezoelectric transducer of claim 18 wherein the mesa groove extends between at least two mesa openings.

- 20) The piezoelectric transducer of claim 15 wherein the mesa interior further comprises air.
- 21) The piezoelectric transducer of claim 15 wherein the mesa interior further comprises a fluid.
- 22) The piezoelectric transducer of claim 15 wherein the mesa interior further comprises a solid.
- 23) The piezoelectric transducer of claim 15 wherein the mesa interior further comprises at least one mesa opening.
- 24) The piezoelectric transducer of claim 23 wherein at least one mesa opening is at least partially filled with adhesive.
- 25) The piezoelectric transducer of claim 15 wherein the mesa interior further comprises at least one mesa groove.
- 26) The piezoelectric transducer of claim 15 wherein the mesa edge support further comprises at least one mesa groove.
- 27) The piezoelectric transducer of claim 26 wherein the mesa groove extends between at least two mesa openings.
- 28) The piezoelectric transducer of claim 1 further comprising a second piezoelectric material element having a second piezoelectric material element width adjacent to the second surface of the chamber diaphragm.
- 29) The piezoelectric transducer of claim 28 further comprising a second mesa having first and second opposing surfaces, a given mesa thickness, and a given mesa width interposed between the second piezoelectric material element and the second surface of the chamber diaphragm.
- 30) The piezoelectric transducer of claim 29 wherein the second mesa further comprises an insulative layer at least partially on the second surface of the mesa.

- 31) The piezoelectric transducer of claim 29 further comprising an electrical contact layer at least partially interposed between the second piezoelectric material element and the second mesa.
- 32) The piezoelectric transducer of claim 28 wherein the second mesa comprises a substantially insulative material.
- 33) The piezoelectric transducer of claim 28 wherein the second mesa comprises a substantially conductive material.
- 34) The piezoelectric transducer of claim 28 wherein the second chamber diaphragm comprises a substantially conductive material.
- 35) The piezoelectric transducer of claim 28 wherein the second chamber diaphragm comprises a substantially non-conductive material.
- 36) The piezoelectric transducer of claim 29 wherein the second mesa further comprises a plurality of mesa openings.
- 37) The piezoelectric transducer of claim 36 wherein at least a portion of the plurality of mesa openings are at least partially filled with adhesive.
- 38) The piezoelectric transducer of claim 29 wherein the mesa further comprises at least one mesa groove.
- 39) A piezoelectric transducer comprising:
- a) a chamber diaphragm having first and second opposing surfaces, a given chamber diaphragm thickness, and a given chamber diaphragm width,
  - b) a mesa having first and second opposing surfaces, a given mesa thickness, and a given mesa width wherein the first surface of the mesa is adjacent to the first surface of the chamber diaphragm and the mesa further comprises a plurality of mesa openings, and
  - c) a piezoelectric material element having a given piezoelectric material element width adjacent to the second surface of the mesa, and

d) an electrical interconnect layer interposed between the chamber diaphragm and the mesa.

40) A piezoelectric transducer comprising:

a) a chamber diaphragm having first and second opposing surfaces, a given chamber diaphragm thickness, and a given chamber diaphragm width,

b) mesa having first and second opposing surface, a given mesa thickness, and a given mesa width wherein the first surface of the mesa is adjacent to the first surface of the chamber diaphragm and the mesa further comprises a plurality of mesa openings, and

c) first and second piezoelectric material elements, each element having a given piezoelectric material element width wherein the first piezoelectric element is adjacent to the second surface of the mesa and the second piezoelectric element is adjacent to second surface of the chamber diaphragm.